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VIKING LABORATORIES INC.

INTERIM
OPERATING & SERVICE
MANUAL
CURRENT STEP GENERATOR
MODEL CSG-1000

INTEGRA
MICROWAVE
A Division of INTEGRA, Inc.
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I N T E R I M
O P E R A T I N G & S E R V I C E
M A N U A L
CURRENT STEP GENERATOR
MODEL CSG-1000

VIKING LABORATORIES INC.

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CSG-1000 - OPERATION

1. General

The CSG-1000 Current Step Generator delivers a step in current between I_1 and I_2 at a fast rate.

In Man-mode the switching is accomplished by pushing the front panel switches I_1 or I_2. The lights on the switches indicate which current is selected. When in I_1 the current I_1 can be adjusted and in I_2 the I_2-current is set.

In automatic mode the switching between both values is done automatic at the rate selected by the Frequency control. In Ext-mode an external signal controls the selection. The I_o setting can be set anywhere between the I_1 and I_2- setting.

After every step a sampling delay pulse is generated and at its end, a sampling pulse is generated. The sampling delay is adjustable at the front panel and in manual delay the "Push for sample" is used to generate a sampling pulse.

The "SYNC-SELECT" is used to choose a sync pulse on a positive step, negative step or both.

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NEW METHOD FOR MEASURING SWITCHING SPEED ON YIG DEVICES

In the last few years Microwave Electronic Systems have increased in sophistication and the combination with computers require new and sophisticated measurements. For YIG devices the switching speed from one frequency to an other is becoming of increasing interest.

Since YIG devices are tuned by electromagnetic means, the most serious limitation on the switching speed is the lag of magnetic field with respect to tuning coil current. This lag is caused by the eddy currents within the magnetic structure to a much more significant extent than the L/R time constant of the coil parameters.

Improvements up to a factor of 10 in switching time are experienced when the solid nickel iron materials are replaced by laminated pole pieces or special ferrite materials.

Ferrite materials suffer saturation effects at higher frequencies, such that they are usable only in devices up to approximately 6 GHz.

Laminated pole pieces are appropriate for devices operating at frequencies above 6 GHz.

The basic switching behavior of YIG devices can be classified with two categories:

1.) SWITCHING SPEED

2.) POST TUNING DRIFT.

SWITCHING SPEED

Since YIG devices are tuned by an electromagnetic circuit, the switching speed is the lag of magnetic field with respect to tuning coil current. This lag is caused by eddy currents within the magnetic structure. Switching speeds are in the order of milli-seconds.

POST TUNING DRIFT

Frequency instabilities also occur minutes after switching from one frequency to another. This phenomenon is known as "post-tuning-drift"

Most post tuning drift are associated with temperature gradients within the magnetic structure.

To measure this drift an accurate and highly stable current step is required.

METHOD OF MEASUREMENT

In the past switching speed measurements were made with the use of stable beat osc., mixers and detectors. This method was difficult at best and sometimes vastly different results could be obtained.

The new method uses a specifically designed Current Step Generator and an Automatic Microwave Pulse Counter. The Current Step Generator supplies a precision output current to the YIG under test which can be stepped to a second current level with high precision. See Fig. 1

The corresponding magnetic field change causes the oscillator to change its frequency from F_1 to the new value F_2 . The current step also triggers an adjustable delay pulse. At the end of the selected delay a sampling pulse is generated which causes the automatic Microwave Pulse Counter to measure the instantaneous frequency. The counter uses a gate width of 100 µs and has been preset in frequency as required by its manufacturer.

The current step can be switched manually to set-up the end frequencies when measuring switching speed or for measuring of post tuning drift.

When measuring the switching speed the current step is switched automatically at a controllable rate. The delay pulse can be adjusted and the delay monitored with an oscilloscope or a time interval counter. A sync selector allows to only generate a sampling pulse for the counter when switching up in current or down in current.

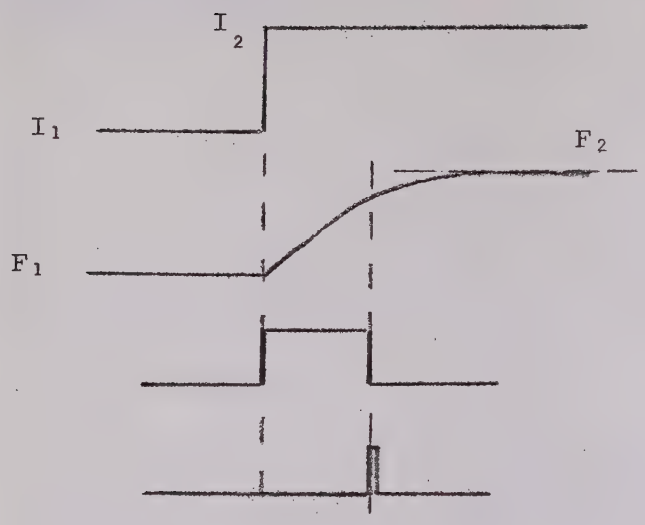
The current step generator has a high drive voltage so that no $L \frac{di}{dt}$ - limitations influence the switching speed.

For measurments of YIG-drives with integral drivers the Current Step Generator provides a fully adjustable voltage output.

When making post tuning drift measurements the delay length can be manually controlled and a sampling pulse is generated by pushing a front panel switch.

When it is desired to automate the entire measurement set-up the Current Step Generator and the Microwave counter can be computer controlled.

This new method allows to make fast, accurate and convenient measurements in R & D, manufacturing and customer inspection facilities.



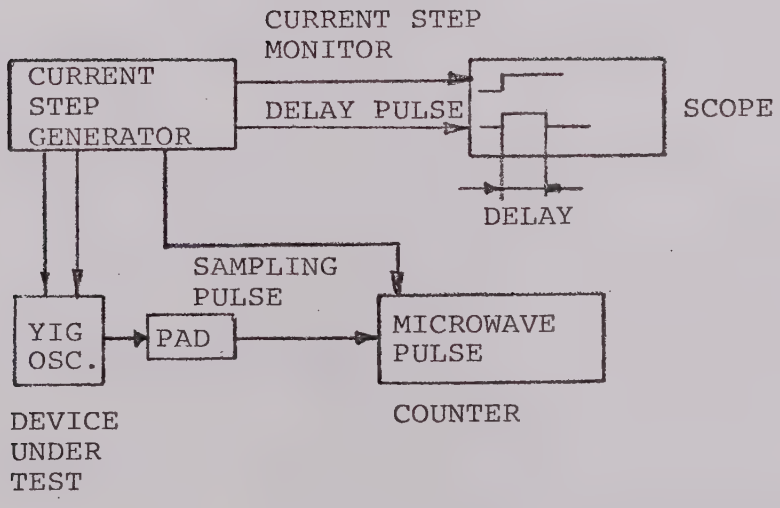
CURRENT STEP FOR YIG COIL

CORRESPONDING FREQUENCY OF YIG OSCILLATOR

DELAY PULSE (ADJUSTABLE)

SAMPLING PULSE FOR AUTOMATIC MICROWAVE PULSE COUNTER

FIGURE 1



TYPICAL SET-UP

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ADVANCED INFORMATION

CURRENT STEP GENERATOR

MODEL CSG-1000

The INTEGRA CURRENT STEP GENERATOR MODEL CSG-1000 was specifically designed for the measurement of switching speeds on YIG-devices. It allows to make measurement in a manual, automatic or remote controlled mode. A precision adjustable current step can be setup over the 0 to 1A range. After the current step an adjustable delay is initiated, and at the end of the delay a sampling pulse is generated. This sampling pulse can be used to make direct frequency measurements with an EIP-AUTOMATIC-MICROWAVE COUNTER MODEL 451.

For the first time Frequency Profile measurements on YIG devices can be done conveniently and accurately by Engineering, Manufacturing and customers.

SPECIFICATIONS:

DC-CURRENT RANGE :	0 to 1A
STEP CURRENT RANGE :	0 to 1A
TOTAL CURRENT (dc $+\Delta I$)	1A
DRIVE VOLTAGE :	40V
NUMBER OF PRESET CURRENTS:	3

OPERATING MODES:

AUTO	Automatic switching between I_1 and I_2 by internal generator. Switching rate adj. by front panel control.
MAN	MANUAL switching between I_1, I_o or I_2. Pushbutton with indicator LED is used for manual switching.
EXT.	EXTERNAL signal switches between I_1 and I_2 - current setting. (see EXT. drive spec. for interface)

CURRENT STEP GENERATOR

DELAY PULSE	Internally generated (adj. over 1-100 ms by front panel controls)
SAMPLING PULSE	Internally generated at the end of the delay pulse.
MANUAL SAMPLING PULSE	Push-button for trigger of a sample pulse in manual mode.
SYNC SELECT	Build in sync select switch to select measurements on I_1 to I_2 step or on I_2 to I_1 - step.
CURRENT OUTPUT	Direct drive of YIG-coil.
VOLTAGE OUTPUT	Voltage output for testing of YIG devices with build in drivers. V_1 corresponding to I_1 and V_2 corresponding to I_2. (0 to +10V total range)
SYNC PULSE	Positive and Negative Sync pulse available. (Sync pulse syncronized with current step)
BLANKING PULSE	Positive and Negative blanking pulse available.
DELAY PULSE	Delay pulse on rear panel available for delay measurements on time interval counter or on oscilloscope.
SAMPLING PULSE	Sampling pulse available on rear panel. Levels compatible with EIP-MICROWAVE PULSE COUNTER MODEL 451.
MONITOR OUTPUT	Output voltage proportional to output current. Scale factor: 1mV/mA.
EXT. DRIVE	External drive switching between I_1 and I_2 . (can be driven with open collector circuit or 15V-CMOS-LOGIC INPUT is 10KΩ to +15 Volts)

CURRENT STEP GENERATOR

MODULATION INPUT	Output current can be modulated through this input.
INPUT VOLTAGE	115VAC, 60Hz.
FUSE	1A, SLO-BLOW
SIZE (HWD)	5.25 x 16.75 x 12.75 inches.
WEIGHT (NET)	22 pounds

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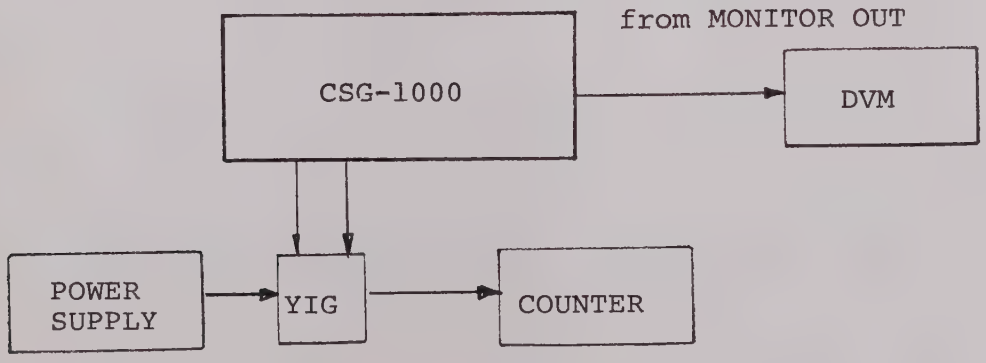
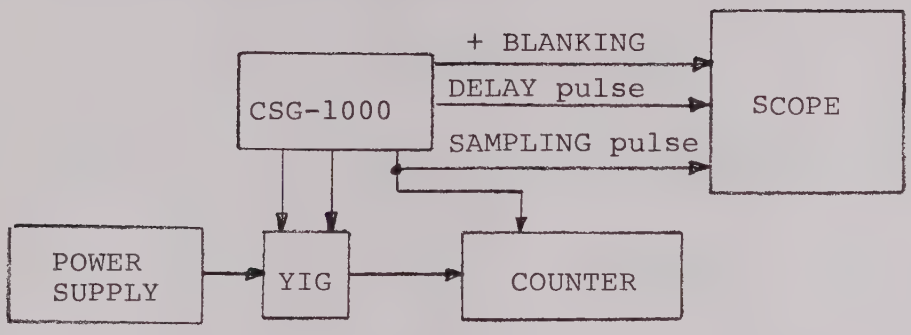
CSG-1000 ADVANCED INFORMATION

1. MANUAL SET-UP

1. Connect YIG to Current output terminal.
2. Set I_1 - control fully CCW.
3. Set I_2 - control fully CCW.
4. Select MAN on MODE switch.
5. Connect counter to Osc. output.
6. Turn on power on osc. and CSG-1000.
7. I_1 - switch light should be on and I_1 - mode is selected.
8. Turn I_1 - CW until desired freq. is obtained from Osc. (vernier is used for fine adj.)
9. Push I_2 - switch and I_2 - switch light should turn on.
10. Turn I_2 - controls CW until desired frequency is obtained.
11. Switch back to I_1 and reset frequency if necessary.
12. Output current can be monitored on the MONITOR OUTPUT on the back panel. (1 mV/ma - output)



AUTOMATIC FREQ. PROFILE - MEASUREMENT



TYPICAL TEST SET UP

1. Set up as under manual operation.

2. Connect SAMPLE-PULSE OUTPUT to EIP-MICROWAVE PULSE COUNTER Model 451 @ rear panel INPUT INHIBIT.

3. Set MODE switch on CSG-1000 to AUTO and set Frequency control fully CCW.

4. Set SAMPLING DELAY to SHORT and set DELAY mid-range.

5. Set SYNC Select Switch to - (negative)

6. Set PRESET FREQUENCY on counter so that the input frequency from the osc. at its low (I_1) setting is 100 Mhz to 325 Mhz above the preset number.

7. Select MANUAL SELECT for preset frequency.

8. Set MIN. PRF- Switch to 0 on rear panel of counter and STORAGE to ON and GATE MODUL. to off.

9. Counter should show the frequency corresponding to I_1-setting if RF-level is sufficient for counter operation. (Use PAD at input of counter if necessary. +10 dBm is max. input.)

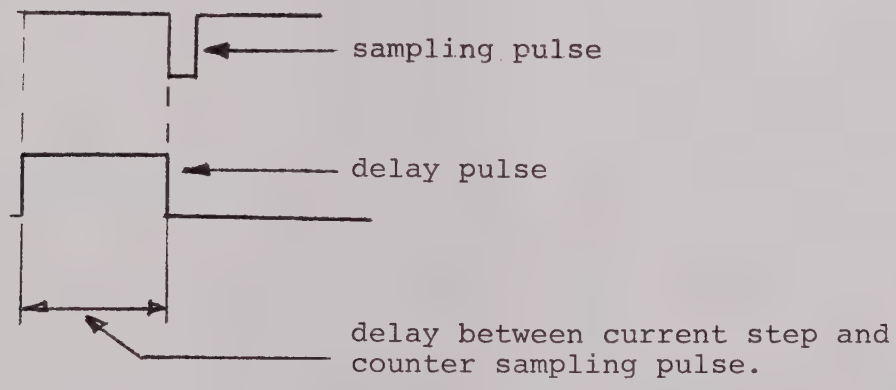
10. Trigger Oscilloscope from + BLANKING output from CSG-1000. (negative edge)

11. Connect DELAY pulse to vertical input of scope. (10V/Div.)

12. Set scope to 2 ms/Div.

13. Connect SAMPLING PULSE OUTPUT of CSG-1000 to second vertical channel of oscilloscope. (1V/Div.)

14.



15. Change delay on CSG-1000 and make frequency profile measurement for 1 ms to 100 ms delay range. For measurements of longer delays e.g. 10 sec. select MANUAL switching mode and MANUAL sampling delay. (Use PUSH FOR SAMPLE - push button)

16. For frequency measurement from I_1 to I_2 - step select + SYNC pulse and preset counter to desired preset frequency. Scope should be triggered on positive edge.

CALIBRATION

Voltage Calibration:

1.) Turn I_1- controls fully CCW.
Turn I_2- control fully CW (large knob fully CW, vernier knob fully CCW.)
Select Man-Mode.
Push I_1-switch and I_1-light should be on.

2.) Connect DVM to voltage output on front panel.

3.) Adj. R17 for 0.00V on DVM.

4.) Push I_2-switch and I_2-light should be on.

5.) Adjust R22 for +10.00V on DVM.

6.) Push I_1-switch and I_1-light should be on.

CURRENT CALIBRATION

1.) Connect Precision 10 Ohm resistor to current output terminals. (50 watts min.)

2.) Select Man-mode; push I_2-switch and I_2-light should be on.

3.) Turn I_2-control fully CW for +10.00 volts on Voltage output on front panel.

4.) Adjust R41 for _10.00 volt accross the 10 Ohm load resistor on the current output.

5.) Push I_1-switch and I_1-light should be on. Turn I_1-controls for +1.00 volts on voltage output on front panel.

6.) Adjust R52 for 1.00 volts across the 10 ohm load resistor for the current output.

7.) Repeat Step 2 to 6 until both are correct.

Monitor Output Calibration

1.) Connect 10 ohm resistor to current output terminals (50 watts min.)

2.) Select Man-mode; push I_2switch and I_2light should be on.

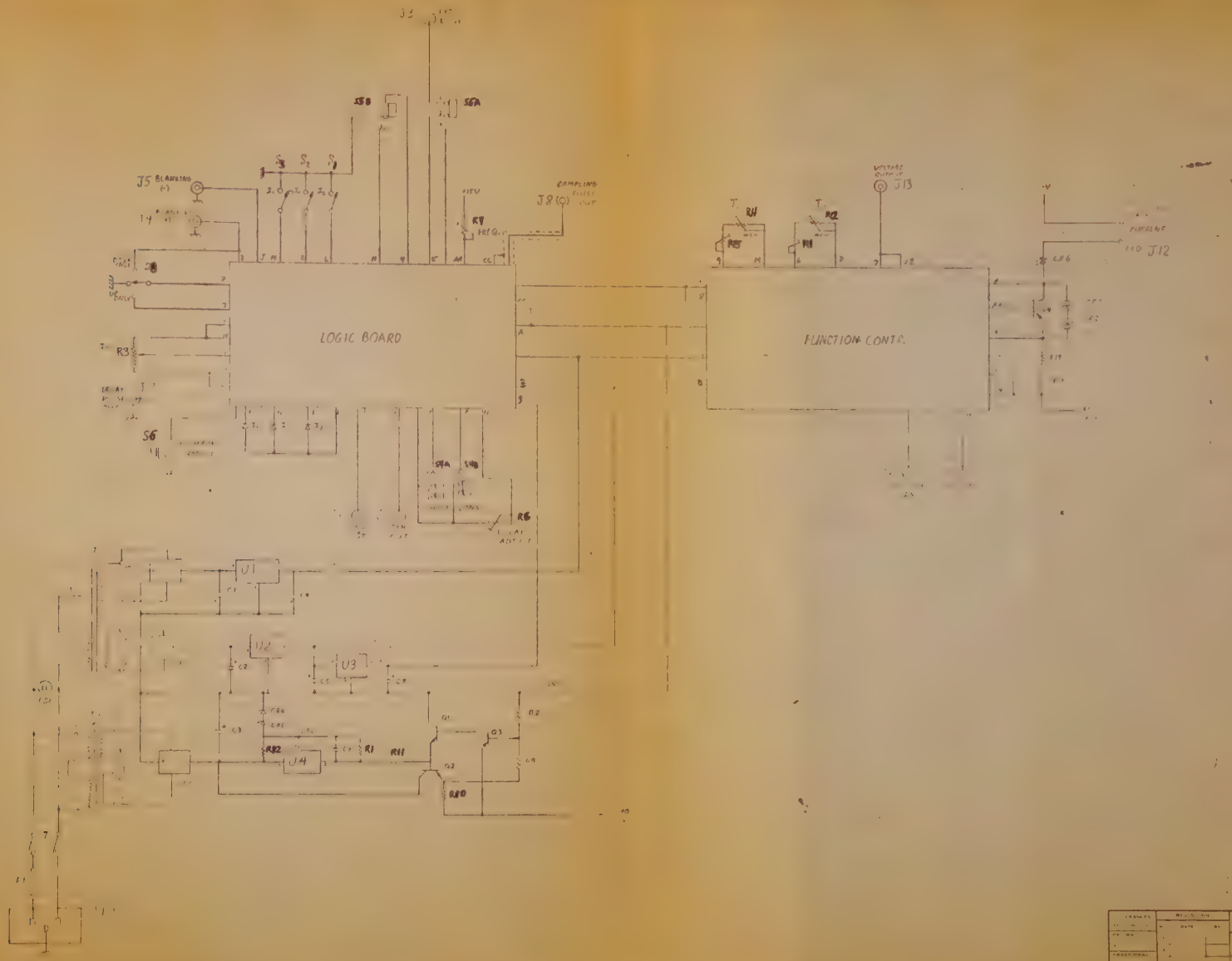
3.) Turn I_2control fully CW for +10.00 volts on voltage output on front panel.

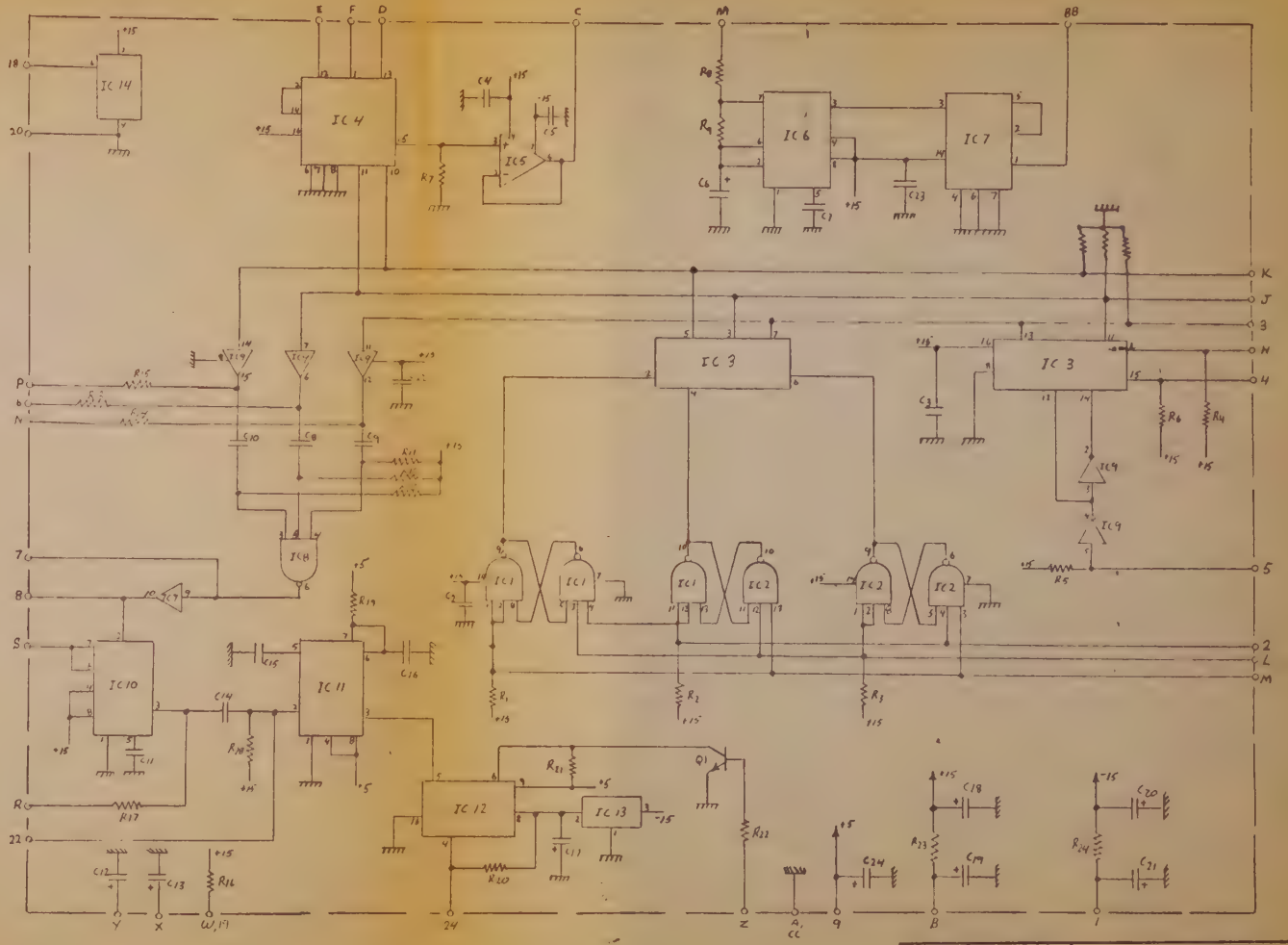
4.) Adjust R58 for +10.00 volts on MONITOR output. (rear panel)

5.) Push I_1switch and I_1light should be on. Turn I_1control for +1.00 volts on voltage output on front panel.

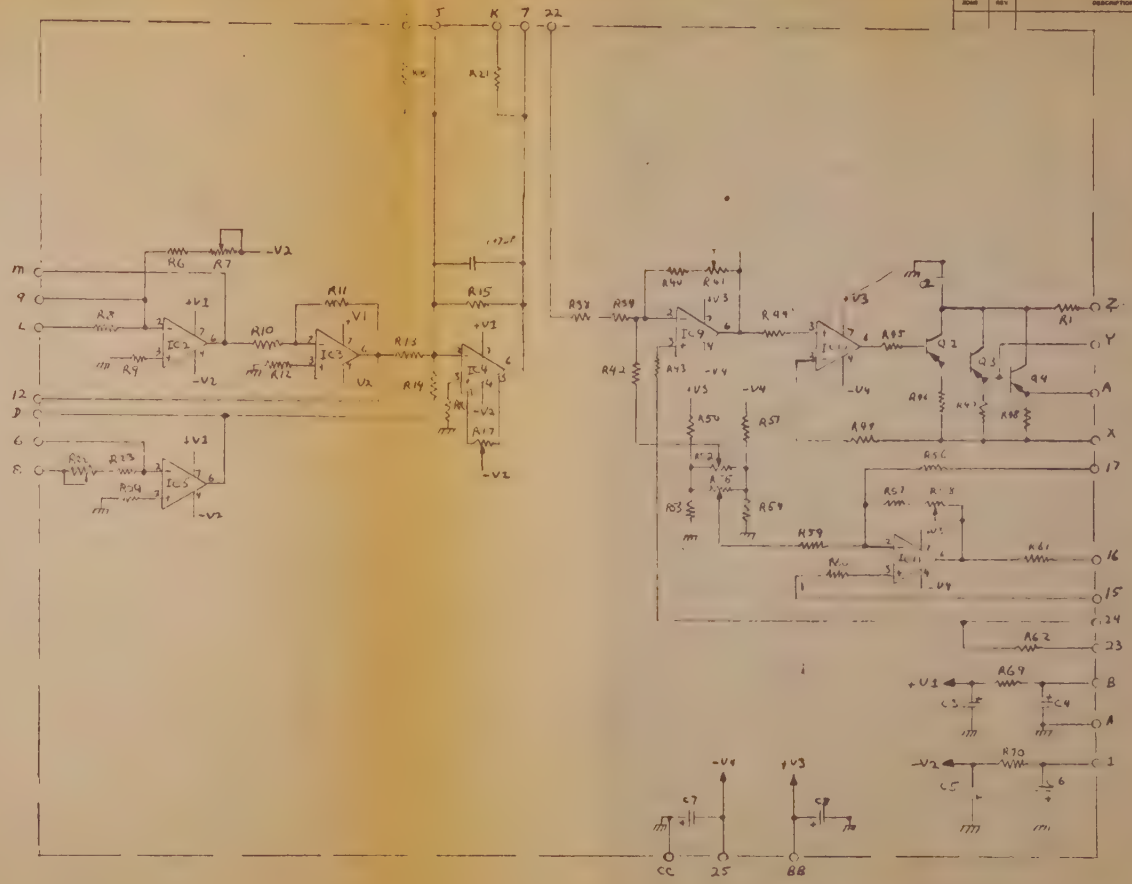
6.) Adjust R55 for +1.00 volts on MONITOR output.(rear panel)

7.) Repeat step 2 to 6 until both are correct.


LOGIC BOARD
FUNCTION CONTR.
J5 BLANKING
J8
J13
J12
S6
S8
S9A
S9B
S10
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
U1
U2
U3
U4
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
Q1
Q2
Q3
CR6
INTEGRA
CSG-1000



TOLERANCES	REVISIONS			INTEGRA
DECIMAL	NO	DATE	BY	LOGIC BOARD
FRACTIONAL				
ANGULAR				DRAWN BY Wm P · SCALE · MATERIAL
				LINED · DATE · DRAWING NO B110131-00
				TRACED · APP'D



REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED

PARTS LIST

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCE ARE
FRACTIONS DECIMALS ANGLES
.X ±
.XX ±

CONTRACT NO.

APPROVALS DATE
DRAWN 5-18-79
CHECKED
ISSUED

C98-1000
MATERIAL
FINISH
NEXT ASSY USED ON
APPLICATION DO NOT SCALE DRAWING

INTEGRA

FUNCTION CONTROLLER BD.

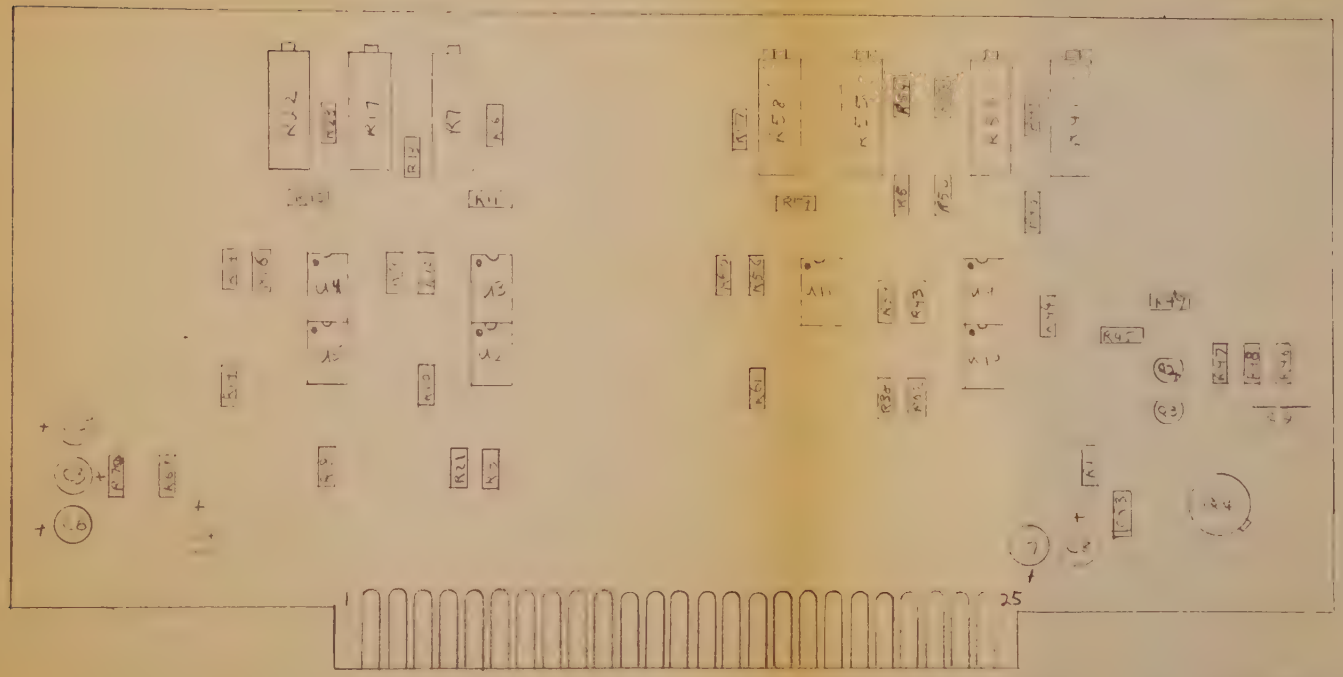
SIZE C FSCM NO. 57162 DWG. NO. 6100, 6-09 REV.
SCALE — SHEET

60-9CC018 ON DWG

BISHOP GRAPHICS, INC
REORDER NO. 20511

B210506-01

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED



QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS . DECIMALS XX ± XXX . ANGLES °	CONTRACT NO	INTEGRA	
	APPROVALS / DRAWN	DATE	FUNCTION CONTROLLER BD.
MATERIAL	CHECKED		
FINISH	ISSUED		SIZE B · FSCM NO. 5116 · DWG. NO. B210506-01 · REV.
DO NOT SCALE DRAWING			SCALE · SHEET

CSG-1000	
NEXT ASSY	USED ON
APPLICATION	

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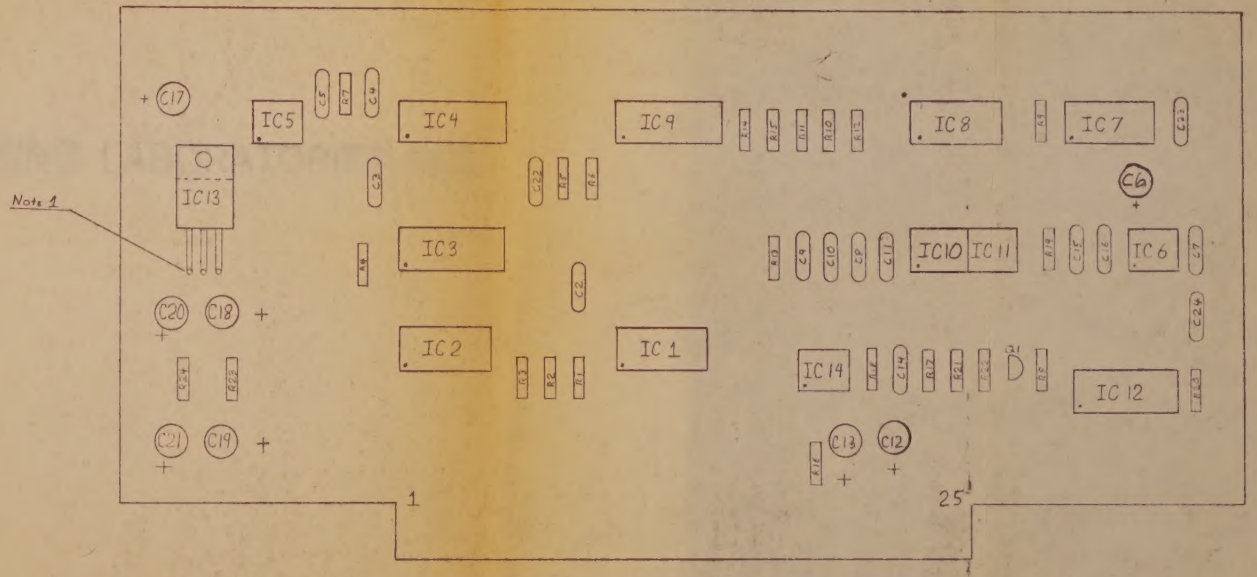
REORDER NO. 20510



Notes
1) Top view

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED

PARTS LIST

QTY REQD	ZONE (USED)	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
.XX ±
.XXX ±

CONTRACT NO.

APPROVALS	DATE
DRAWN	
CHECKED	
ISSUED	

MATERIAL

FINISH

NEXT ASSY. USED ON

APPLICATION

DO NOT SCALE DRAWING

CSG-300B

INTEGRA

LOGIC BOARD

SIZE C | FSCM NO. 51162 | DWG. NO. B210131-01 | REV.

SCALE 1:1 | SHEET

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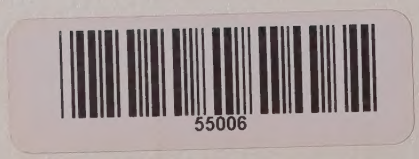
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